

COMPUTER DIAGNOSIS

L. Kruglov

Translation of "Diagnoz stavit mashina," Sel'skaya Zhizn',
Newspaper, Nov. 3, 1973, p. 4

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16. Abstract This new article outlines the work done by the Cybernetics Laboratory of the Institute of Surgery im. A. V. Vishnevskiy (USSR Academy of Medical Sciences). The laboratory has a computer (E-220), capable of 30 thousand operations per second, which is programmed to diagnose 66 kinds of heart defects, various internal diseases, jaundice, rheumatism, acute peritonitis, and many other ailments. Doctors in clinic and hospitals outside of Moscow can reach the computer through a teletype network. The laboratory was founded in 1961 and is now headed by Chief Engineer Yu. K. Astashev and Deputy M. A. Lerner.			
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Two days after the operation, the mother made up her mind and handed her son the mirror. The little boy looked and did not recognize himself. /4*

"Mother, why have they put a white mask on me?" His voice was scarcely audible, he carefully passed his hand over his cheek and realized that he was mistaken, for the first time in many months he smiled.

How well that 7-year-old boy knew that his skin always had a bluish tint, so characteristic of children who are suffering from the same congenital heart defect, when dark venous blood mixes with arterial blood enriched with oxygen owing to the absence of a partition between the ventricles of the heart.

Now the blueness of the skin of the hands and face has suddenly disappeared as if it were never there. It disappeared soon after a senior scientific worker of the Institute of Surgery im. A. V. Vishnevskiy, a Candidate of Medical Science Egor Vladimirovich (Pshenichnikov) and an assistant surgeon, Mikayl Yevgen'yevich (Sargin) performed an operation on the boy, directed the blood along a new stream -- an artificial one, bypassing the restricted mouth of the pulmonary artery.

It was a complicated and desperate struggle for the life of the 7-year-old Yura Grivtsov from the settlement of Novosergiyevka in the Orenburg district. The boy was suffering not from one, but from several heart defects. Which method should one choose to

* Numbers in the margin indicate pagination in the foreign text.

relieve the child's suffering? The surgical intervention method was chosen; however, by more than just a consultation of doctors.

Let us leave for a moment the ward on the eleventh floor of the main building of the Institute of Surgery, where Yura Grivtsov is lying, to meet the people, who in a few seconds, and I repeat seconds, gave the correct diagnosis of the boy's disease.

In a two-story house, unobstrusive beside a glittering, aluminum skyscraper on Bol'shaya Serpukhovskaya street of the capital, lamps are twinkling on the control panel of a large electronic computer and large spools of wide magnetic tape are rotating. This is the kingdom of electronics. Why is it here in the precincts of a medical institution? What has all this to do with a complicated operation undergone by a 7-year-old boy? There is a direct link apparently.

I sit with the chief engineer of the Cybernetics Laboratory of the Institute of Surgery, Yu. K. Astashev in one of the cul-de-sacs of the "maze" of electronic machinery shining with lacquer and nickel.

"The success of any treatment mainly depends on the correct diagnosis of the illness," said Yuri Konstantinovich. "An experienced doctor will quickly deduce the common denominator and the symptoms of the illness and the results of analysis and complaints of the patient himself are given afterwards. The greater the amount of information, the more precise becomes the picture of the ailment. On the other hand, try to compare lots of different information on a person's health, compare and try to give a correct answer quickly. This needs time. And indeed, in a doctor's practice there are moments when a decision must be made not in days nor hours. This was the case with Yura Gritsov, of whom you were asking. We quickly fed into the "memory" of the machine the sick child's

by

symptoms, and the machine began processing. There was not time to lose: Yura was brought to the Institute in a serious condition. Only an emergency operation could help him."

A teletype is printing the doctor's conversation with the M-220 computer on telegraph tape. Laboratory engineers have programmed the computer to given explanations not only in digits but simply in Russian. Here is the terse dialogue between the machine and the doctor.

Machine: Let us begin work. The program?

Doctor: Diagnostics.

Machine: Type of illness?

Doctor: Congenital heart failures.

Machine: Symptoms of the illness?

Afterwards, one must feed a set of digits into the system -- coded illness symptoms. How many there are!

After a few seconds, the machine prints its diagnosis: "The probability of this type of congenital heart defect is 91%." It immediately became clear which operation would be best to help the child.

Twelve years ago in the Institute of Surgery im. A. V. Vishnevskiy (Academy of Medical Sciences of the USSR) a Cybernetics Laboratory was set up, under the guidance of Professor M. L. Vykhovskiy, a doctor of technical sciences. Scientists decided to put into practice the ideas of Alexandra Eleksandrovich Vishnevskiy, a prominent Soviet surgeon, and a director of the Academy of

Medical Sciences of the USSR, on the use of computers in medicine, including for diagnoses in complicated cases. Remember that Yura Gritsov's diagnosis was very complex.

Scientific workers began working in the newly completed laboratory in 1961 by sifting through the archives of the greatest clinics in the country and statistically processed old cases of illnesses. Hundreds of symptoms of all existing forms of the most frequent congenital heart defects were printed on cards.

The laboratory assistants will always remember the day when symptoms for a whole range of cardiac illnesses were first fed into the "memory" of the computer, and how it began to compare the huge volume of information with the signs of illness of one particular person.



In the photograph: Ye. Brodetskaya, a program engineer, and S. Samorodov, a senior engineer at the computer control panel.

The first steps into the unknown were by no means faltering. Young doctors, engineers, mathematicians and programmers suddenly realized that everything in life was interlinked and their

professions were not separated, but brought closer together in the noble cause of fighting for a person's life.

"In principle, our computer works exactly in the same way as an experienced doctor, giving a diagnosis," said M. A. Lerner, the deputy director of the laboratory, at this point. "Experience of the greatest Russian clinics is fed into the machine."

Khabarovsk and Balkhash, Vil'nyus and Chelyabinsk, Cherskassy and Novochoerkassk, Dubna and Odessa -- clinics, hospitals and sanatoriums of all these cities have teletypes, linked with the Cybernetics Laboratory. Doctors here receive accurate, comprehensive answers for ailments which they must cure.

Today, apart from diagnosing 66 types of congenital and acquired heart failures, the computer, carrying out up to 30,000 operations per sec, diagnoses the most complicated internal diseases, jaundice, rheumatics, acute affection of the abdominal cavity and many other ailments, which can be cured by the scalpel.

However, the machine is only an intelligent and accurate instrument in the hands of a doctor and by no means replaces him. A computer, giving medical diagnoses, simply makes the doctor's work easier.

Yura Gritsov recovered. He tells me about his brother Anatoli who works at the "Robeda" kolhoz where he has been invited as a guest to the village of Staraya Belogorka. His eyes light up when he recalls friends of his own age. Children rode on his bicycle, because he could not.

"He walked a little, became tired and squatted a little. It is becoming easier for me. Now that I have recovered I shall ride myself!"

Get better, Yura! The doctors did all that was possible and was not possible so that you and hundreds of other people, to whom they gave help at the institute, became better and were not deprived of life's pleasures. People also helped you, whose diplomas said that they were not doctors but engineers. They did not take the Hippocratic oath, but have a right to wear the white medical smock with pride.